

## **Calorimetric study of non-isothermal crystallization kinetics of $\text{Au}_{50}\text{Cu}_{25.5}\text{Ag}_{7.5}\text{Si}_{17}$ Bulk Metallic Glass**

**Maryam Rahimi-Chegeni<sup>۱</sup>, Mahmoud Nili-Ahmadaabadi<sup>۲</sup>, Mahdi Malekan<sup>۳</sup>**

*1- School of Metallurgy and Materials, College of Engineering, University of Tehran, Tehran, Iran*

[Rahimi.maryam@ut.ac.ir](mailto:Rahimi.maryam@ut.ac.ir)

### **Abstract**

Non-isothermal crystallization kinetics of  $\text{Au}_{50}\text{Cu}_{25.5}\text{Ag}_{7.5}\text{Si}_{17}$  Bulk Metallic Glass (BMG) has been investigated by Differential Scanning Calorimeter (DSC). The results show that crystallization in this bulk metallic glass has one stage crystalline precipitation process during continuous heating. The glass transition and crystallization kinetics have relations to the continuous heating rate. Under non-isothermal conditions, activation energies corresponding to the characteristic temperatures were estimated by Kissinger and Ozawa equation. The calculated activation energies of  $E_g$ ,  $E_p$  and  $E_x$  revealed that the energy barrier for the glass transformation is higher than that for crystallization. The activation energy calculated from the crystallization peak temperature  $E_p$  represents the energy barrier for growth and the activation energy  $E_x$  for onset crystallization shows the energy barrier for nucleation.

**Keywords:**  $\text{Au}_{50}\text{Cu}_{25.5}\text{Ag}_{7.5}\text{Si}_{17}$  Bulk Metallic Glass, Crystallization kinetics, Activation energy.

### **1.Introduction**

Because of the lack of long range order in the atomic assembly, bulk metallic glasses (BMGs) exhibit many unique properties compared with crystallized counterparts, such as high elastic limit, excellent strength and hardness, and good corrosion resistance [1] [2]. Therefore bulk metallic glasses are potential materials for various structural and functional applications [3]. However, bulk metallic glasses are metastable materials and will transform into crystalline state upon heating, resulting in the changes of the structure and inherent properties [4]. As a result, the investigation

<sup>۱</sup>- M.Sc. Student, Metallurgy and Materials Engineering

<sup>۲</sup> Professor, Metallurgy and Materials Engineering, nili@ut.ac.ir.

<sup>۳</sup>- Professor, Metallurgy and Materials Engineering, mmalekan@ut.ac.ir.